INSTITUTIONAL AND POLICY ANALYSIS OF RIVER BASIN MANAGEMENT

The Warta River Basin, Poland[1]

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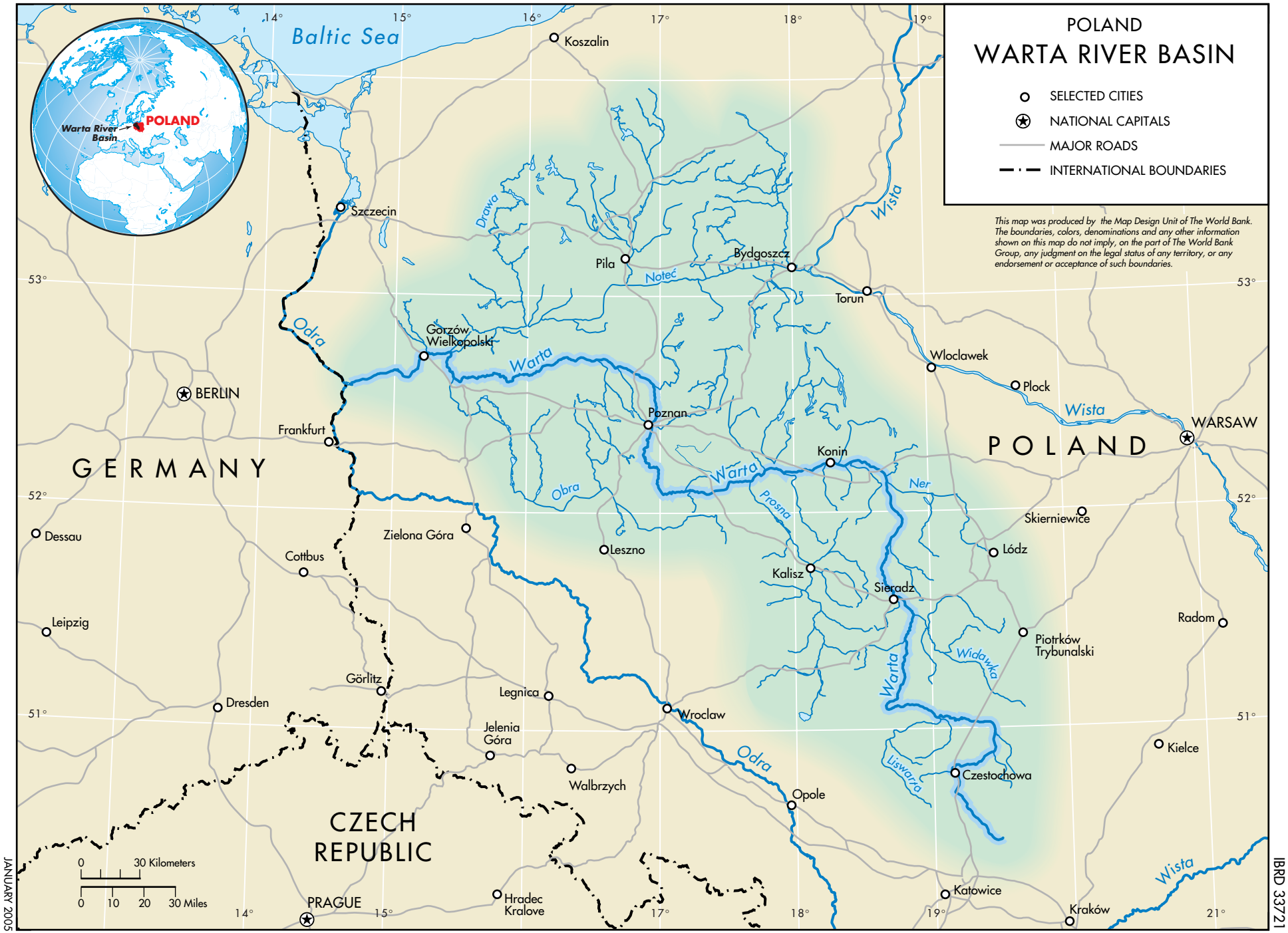
POLAND
WARTA RIVER BASIN
SELECTED CITIES
NATIONAL CAPITALS
MAJOR ROADS
INTERNATIONAL BOUNDARIES
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Baltic Sea
Warta River Basin
POLAND
GERMANY
CZECH REPUBLIC
BERLIN
PRAGUE
WARSAW
Koszalin
Szczecin
Pila
Bydgoszcz
Torun
Wloclawek
Plock
Gorzów Wielkopolski
Poznan
Konin
Frankfurt
Dessau
Cottbus
Zielona Góra
Leszno
Kalisz
Sieradz
Skierniewice
Lódz
Radom
Piotrków Trybunalski
Leipzig
Görlitz
Dresden
Legnica
Wroclaw
Jelenia Góra
Walbrzych
Opole
Kielce
Czestochowa
Katowice
Kraków
Hradec Kralove
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JANUARY 2005
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1. Background and Introduction

Integrated water resources management (IWRM) and organizing it primarily at the river basin level are two of the most common and widely repeated recommendations in the water resources literature of the last decade if not longer (Allee 1988; Galloway 1997; McDonald and Kay 1988; World Bank 1993). Basin management is often associated with the concept of decentralization, of managing water resources at the "lowest appropriate level." (See, e.g., International Conference on Water and the Environment 1992; Mody 2001.) Several conceptual arguments have been presented in favor of decentralization in water resource management, and basin-level management in particular, including that the whole array of resources and use patterns in the basin will be taken into account, management decisions will be based on better knowledge of local conditions, and incentives for stakeholders to actively participate in management will be stronger.

Empirical studies of river basin management systems provide opportunities to examine the claims made for basin-level integrated resources management, and to explore factors that appear to influence its implementation and outcomes. In this research project the project team has searched for those factors and their relationships to river basin management in two ways: with a survey of river basin organizations throughout the world, and with case studies of eight river basins analyzed in greater detail. Some of those eight cases have long histories of basin-scale institutions for water resource management, such as the Guadalquivir river basin in Spain and the Murray-Darling river basin in Australia. Others have emerged recently, as in the Warta river basin in Poland, where the Polish government established regional water management authorities over the past 15 years.

This case has been extremely valuable because the formation of the river basin authorities in Poland was a central government initiative that occurred in the fairly recent memory of many individuals who are still actively involved in water and government, and whose perspectives on the origin, growth, and recent difficulties of the basin management effort are both fresh and rich. The Warta basin therefore provided an opportunity to explore a decentralization reform that included the creation of river basin organizations.

This paper focuses on analysis of the establishment of the river basin organizations in Poland, the extent of their integration or coordination with other governmental bodies that have water-related responsibilities, and the impact of reforms to Polish water law. More detailed information about the river basin, the history of Polish water management, and the structure of government in Poland may be found in the background paper by Tonderski and Blomquist (2003).

2. Analytical Framework

To analyze the data gathered for this project from the case studies and from the survey of river basin organizations, the project team has developed a framework that identifies a number of political and institutional factors which may be associated with the emergence, sustainability, and success or failure of decentralized approaches to IWRM at the basin scale. These factors, and their hypothesized relationships with basin management in a country that has decentralized or is attempting to decentralize water resource

management institutions, are derived from the institutional analysis literature relating to water or other natural resource management and to decentralized systems (especially Ostrom 1990, 1992; also Agrawal 2000; Alaerts 1999; Blomquist and Schlager 1999; Bromley 1999; Easter and Hearne 1993; Wunsch 1991).

Our information gathering and analysis focuses on the following sets of variables.

- Contextual factors and initial conditions
- Characteristics of the decentralization process
- Characteristics of central government/basin-level relationships and capacities
- The internal configuration of basin-level institutional arrangements
- Motivation of stakeholders

Variables considered within each set are listed in the appendix. The Warta Basin case is discussed in terms of these categories and variables in Section 8.

3. Methodology

A case study approach was pursued for this project in order to examine closely the processes of institutional change as well as the current situation. An expert in environmental policy facilitated the site visit, arranging interviews and preparing a background paper on the basin prior to the visit (Tonderski and Blomquist 2003). Background papers for all case study visits are based on a common outline. During the site visit, team members met with and interviewed 14 individuals, including central and local government officials, staff of the river basin authority, and academic researchers with perspectives on governmental structure and water management in Poland.[2] The semi-structured interviews were conducted with a view to understanding the processes of institutional origin and change within the Warta basin, the incentives of different stakeholders related to such change, and the performance of water management institutions at sub-basin, basin, and national scales, matters that were closely within the knowledge of the interviewees. After the visit, team members combined their notes from the interviews, revisited and revised the basin background paper, reviewed other materials, and composed this summary and analysis.[3]

The following analysis of the Warta basin case is therefore based on a combination of sources—documentary materials on Poland and the Warta basin, the background paper prepared for the visit, and the interviews conducted during the site visit. The findings and conclusions therefore do not represent the point of view of a single individual or organization, but emerge from a composite of data collected and reviewed by the research project team.

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[2] Organizations from which individuals were interviewed included the Polish Bureau of Water Management, the State Council of Water Management, the Regional Water Management Authority in Poznań and in a local office in Skeczniew, the Department of Environmental Protection and Agriculture of the Voivodeship of Wielkepolski, the Wielkepolski Voivodeship Fund for Environmental Protection, the Poviat of Poznań, the Municipality of Poznań, the Poznań Water Utility, the Municipality of Tarnowo Podgorne, and the Tarnowo Podgorne Inspectorate of Environmental Protection.

[3] A review and extensive comments on an earlier draft of this paper were provided by Krystian Piechowiak, and are greatly appreciated.

4. Water Management Issues and Stakeholders in the Warta River Basin

4.1 Physical Characteristics of the Basin

The Warta River[4], in western Poland, is the largest tributary of the Oder, which forms part of the boundary between Poland and Germany. The Warta is Poland's third largest river after the Oder and the Vistula. The river flows north from its headwaters in the mountains of southern Poland, then west to the Oder, and is 808.2 km in length with approximately 735 km navigable. Major tributaries of the Warta include the Noteć (388.4km long), Prosna (216.8km), Drawa (185.9km), Obra (163.8km), Gwda (145.1km), Ner (125.9km), and Wełna (117.8km) rivers.

The Warta River basin's 55,193 km^2 area covers approximately one-sixth of Poland. The basin is divisible into three major sub-basins: the Upper Warta sub-basin (including the Prosna River watershed) which covers about 20,825.6 km^2; the Middle and Lower Warta sub-basin (to the river mouth at the confluence with the Oder) which covers about 17,033.5 km^2; and the Upper and Lower Noteć sub-basin which covers 17.333,9 km^2.

In addition to the streams and rivers, the basin contains numerous lakes and reservoirs. Small reservoirs are used for agricultural purposes, while larger ones in the upper sub-basin and on the major tributaries provide flood protection and water storage for recreation and for industry.

Land use in the basin is 70% agriculture and forestry, 30% urban and industrial. The basin's population is about 6,770,000, over 34% of which live in cities. By far the largest city in the region is Poznań, the capital city of Wielkopolska Voivodeship[5], with a population of approximately 600,000. Within Poznań's boundaries alone the river runs for 20 kilometers. Although the city of Lódz has 800,000 residents, it is not entirely within the Warta basin.

4.2 Principal Water Resource Management Issues

The largest water resource management challenge in the Warta River basin for quite a while has been water quality impairment resulting primarily from human uses. There are also issues of water supply availability and reliability, and of flood control. These management issues are linked closely with water uses, of which the largest categories in the basin are industrial (75%), municipal (17%), and agricultural (7%).

Industrial use is primarily surface water, and agriculture is a combination of surface water and groundwater. Nearly all municipalities in the basin rely on groundwater resources for potable uses because it is generally of better quality than surface water and requires less treatment prior to use. Only the cities of Poznań, Oborniki, and (for the time being) Łódź use surface water for a significant part of their

[4] See map at the beginning of the paper.

[5] *Voivodeships* are regional levels of governmental administration in Poland, headed by voivodes – state-governmental bodies. In relation to self-government functions the same regions are usually called provinces. Regional and local government structure is fairly complicated, and is explained more fully in Tonderski and Blomquist (2003).

potable use; Łódź is phasing out its reliance on surface water and will soon use only groundwater.

Industry is generally located around the basin's larger cities, with heavy industry concentrated in Poznań, Częstochowa, Ostrów, Gorzów, pharmaceuticals and chemicals in Pabianice, Poznań, Gorzów and Inowrocław, and textiles concentrated around Łódź and Pabianice. The timber and pulp industry is predominant around the Noteć River and its tributaries, and coal mining has occurred around Konin and Bełchatów. Farming is prevalent in the areas around Sieradz, Kalisz and Poznań. Food processing plants have located in the region as well. There is a high concentration of fruit processing industry around Kalisz and Poznań, grain processing industry around Sieradz, Poznań and Kruszwica, and sugar factories throughout Wielkopolska Voivodeship.

4.2.1 Water Quality

Concentration of industry, agriculture, and urban populations in the Warta Basin has contributed to poor surface water quality. Even in recent years, observers have characterized surface water quality of the Warta River itself as "generally poor" (Przybylski 1993: 500). Niemczynowicz (1992: 179) reported that as of 1990 only 8.7 percent of the Oder River Basin (which for these purposes included the Warta River) met Poland's Category 1 standards,[6] suitable for domestic water supply and salmonid fish habitat. Water in another 24.9% of the basin met Category 2 standards (suitable for other fish species and for recreational uses), and 24.4% met Category 3 standards (suitable for industrial use). The remaining 43.0% was not suitable for any uses. The corresponding percentages for the Oder River without its tributaries were 0.0% (Category 1), 6.8% (Category 2), 28.9% (Category 3), and 64.3% (none), which suggests that tributaries such as the Warta are in better condition than the main stem of the Oder, though still not very good.

All of the municipalities contribute sewage waste to the rivers in the basin. The volume of wastewater discharges requiring treatment is about 2,900 Mm^3 annually in the Warta basin—most of which is municipal wastewater, even though industrial water use exceeds municipal, since a large portion of industrial use is for cooling water that does not need comparable treatment prior to discharge. On the other hand, the amount of wastewater discharged from municipal and industrial sources fell during the 1990s, partly due to reduced water use and partly due to the imposition of fees upon dischargers.

Łódź contributes the largest total volume of sewage discharge to the river, followed by Poznań. Until 1990, 99.7% of sewage discharged from the Łódź metropolitan area was discharged to the Ner river, tributary of the Warta, with no biological treatment. Large cities are not the only problem, however. As of 2001, 859 out of 884 Polish towns were sewered, but as many as 66 had no sewage treatment plants, so their sewage collections are discharged directly to receiving waters (GUS 2002). Even

[6] Evaluation methods for determining surface water quality in Poland still differ from EU methods, so these categories do not correspond precisely with the EU categories of A1, A2, and A3. Nor does the Polish system that is still in use differentiate the quality standards of different water bodies based on their actual or intended use. Waters are simply classified based on their worst-performing pollution indicator. Thus, these measures may overstate the water quality problems somewhat, though it is impossible to say how much.

in the towns that have treatment plants, many are insufficient in terms of capacity and level of treatment (particularly with respect to removing biological material).

Similarly, as of 2001, 1,362 out of 2,547 large industrial sites in Poland have no treatment plants, and 108 of the plants in operation have insufficient output. Another crucial water quality problem is contamination from nonpoint sources, which can include agricultural as well as industrial pollutants carried from the land surface to receiving waters. Nonpoint pollution is responsible for 60-70% of the country's total nitrogen compounds burden (Tonderski, 1997; GUS, 2001a), 40% of organic contaminants (GUS, 2001a), and 30-40% of phosphorus load (Tonderski, 1997; GUS, 2001a).

In most cases, groundwater in Poland meets the requirements of European Union (EU) and World Health Organization standards. (Blaszczyk 2002) Nevertheless, groundwater is threatened by nonpoint sources such as agricultural runoff and the large quantities of industrial pollution discharged to land surfaces as well as to streams and lakes. These discharges seep into the soil, carrying contaminants to the groundwater. Such contamination jeopardizes shallow groundwater all over Poland. (Niemczynowicz 1992: 180)

4.2.2 Water Supply Availability and Reliability

In terms of water availability per capita, Poland is one of the most nearly water-poor European countries, and precipitation and runoff in the Warta River basin are below even the national average (Kundzewicz and Chalupka 1994). The areas with the most frequent and largest water shortages are found in the belt of central Poland, including the Warta River basin. Four of the Polish voivodeships with the lowest average runoff per capita (in m^3/person/year)—Śląskie (~700), Łódzkie (~900), Kujawsko-Pomorskie (~950) and Wielkopolskie (~950)—lie partly or entirely in the Warta River basin. The most difficult situations are those of Śląskie, Łódzkie and Wielkopolskie (all of which are partly or entirely in the Warta basin), which have almost no transboundary inflows as well as less local precipitation and runoff. Fortunately, central Poland is relatively better off than the rest of the country in terms of groundwater resources. Groundwater resources are least in the mountains and foothills of southern Poland, and greater in the central and northern plains.

Average annual precipitation in the Warta basin is about 600 mm. The basin's total water resources are approximately 6,974 Mm^3 per year, of which about 3,753 Mm^3 can actually be used (Kundzewicz and Chalupka 1994), and even less in reliable (meaning available 95% or more of the time). The total water resources translate to a little more than 1,000 m^3 per person per year, far below the 4,560 m^3 per person mean for Europe as a whole.

As in many parts of the world, precipitation and runoff in Poland vary substantially from one season to another. The greatest volumes of surface flow occur in late spring (with April the peak month on average), and the smallest in autumn (with September the lowest month on average). Supplies also fluctuate from year to year, with mean low flows amounting to only 25% of average flows. Drought conditions can occur in the Warta basin, most recently in 1991-92 when a severe drought caused large losses to the economy and ecology of the region. The winter of 1991-92 was practically without snow, followed by a spring and summer of below-normal rainfall. In June 1992, at the worst of the drought, precipitation at Poznań was a mere 3 mm—less than 5 percent of

the monthly average of 61 mm. Crop yields for 1992 fell to just 35 percent of normal, and soil erosion accelerated as a result of the amount of bare soil surface in the basin. Wildfires plagued the basin to an unprecedented degree, and the public was excluded from entering forests throughout the entire Poznań province. Groundwater levels dropped, some smaller streams dried up completely, and all rivers and streams diminished sufficiently to cause harm to aquatic and riparian habitat and species (Kundzewicz and Chalupka 1994).

One way to increase the available resources is to store water in reservoirs, which has been a significant aspect of Poland's past approach to water management. In the Warta River basin, the most significant reservoirs in the basin are Jeziorsko, Poraj, Pakość, Piaski-Szczygliczki, Gołuchów, Sieradz, and Brzózki. The two largest reservoirs on the main stem of the river are the Poraj and Jeziorsko. The Poraj reservoir, located near the headwaters of the Warta, was built to secure water supply for the Częstochowa Steelworks and to provide good conditions for recreation around its shores. The Jeziorsko reservoir, completed in 1986, is located closer to the middle of the main stem of the Warta. It was built chiefly for protecting Konin and Poznań against floods, but also provides electricity, some habitat protection,[7] and supplemental water for drought periods. (Penczak et al. 1998) With a total volume of 203 million m^3 and operational volume of 170 million m^3, and a reservoir surface area of 42,000 ha, Jeziorsko is the principal flood protection structure in the basin.

4.2.3 Flood Control

Jeziorsko reservoir, with surface area of 42,000 ha, a total volume of 203 million m^3 and an operational volume of 170 million m^3, is also the principal flood protection structure in the Warta River basin. Legendary floods have been experienced in the Warta basin from the beginning of the 20th century to the very recent past, most notably 1997. Considerable effort in Polish water management generally, and in the Warta basin specifically, has been directed toward developing structures to prevent flooding as well as store water for droughts. The floods of July 1997 unveiled many shortcomings and defects in the flood protection system throughout the country. After the flood the Polish government adopted a National Program of Reconstruction and Modernization. Local and regional flood protection and prevention plans have been developed, with their implementation assisted financially by a central government office created in the aftermath of the floods, the Plenipotentiary for Removal of Flood Effects.

4.2.4 Major Stakeholders

The greatest interests in Warta River basin management are those of municipal water suppliers, industries, and agriculture. Regional governments (the voivodeships), the national government, and environmental organizations also have considerable interest in a river basin of the Warta's scale and significance.

The interests and activities of local and regional stakeholders within the basin do not appear to have driven the creation of the principal organizations for river basin management in the Warta basin, however. The institutions created in the Warta basin

[7] In order to secure the habitat for water birds, a stable rising level is maintained in the breeding season from April 1st to June 20th.

from 1990 to the present—including the Regional Board of Water Management and then Regional Water Management Authority in Poznań (RWMA Poznań)—were created in basins throughout Poland at the same time and in largely identical fashion.

Water quality is primarily a concern for the local governments and utilities supplying potable water for domestic use and discharging wastewater (treated or not) to the receiving waters in the basin. As municipalities have switched primarily to groundwater, their concern with maintaining its quality (which saves them considerable treatment expense) has risen accordingly. Their concerns with surface water quality relate primarily to the stringency (and associated expense) of treatment requirements, but also to recreational and aesthetic aspects of the rivers, streams, and lakes in their vicinity.

The regional and national governments' concerns with water quality are associated with the funding of water quality improvement facilities—national and voivodeship funds are the primary source of governmental financial support for improved treatment facilities—and with satisfying national and EU water quality standards. Ecological and recreational aspects of water use also form a basis for regional and national government interest, as well as that of some nongovernmental organizations.

Water supply availability and reliability are of principal concern to industrial and agricultural water users in the basin, since they rely to a greater degree on surface water supplies than do municipal suppliers. Low flows and drought conditions have the potential to jeopardize the operation of industrial water intakes and irrigation canals.

Flood control is primarily of interest in the urban concentrations along the rivers in the basin, due to the potential injury and economic losses associated with flooding. As noted already, the national government has taken a particular interest in stimulating better flood protection and response at the regional and local level throughout Poland.

5. Institutional Arrangements for Water Management in the Warta River Basin

An understanding of the institutional arrangements that operate in the Warta River basin involves at least three principal elements. First is the river basin agency for the Warta basin, RWMA Poznań. As noted, introduction of the river basin approach to water resources management was a central initiative coming from the national level.. Second is the development of integrated water resource management (IWRM) and river basin management in Polish water policy and law. Third is the myriad other national, regional, and local governmental bodies with responsibilities for water management in the Warta basin and in Poland generally. Further details concerning the historical development of Polish water policy and law, Poland's governmental structure, and the organizations that perform various water management functions in the Warta basin are available in Tonderski and Blomquist (2003).

5.1 The Regional Water Management Authority in Poznań (RWMA Poznań)

During the postwar decades of Soviet dominance, Polish governance and policy emphasized central government planning and control. Water resource planning and management exemplified this trend: from 1960 to 1972, a central Institute of Water Management was responsible for water planning and use, and analysis of water resource information. A restructuring in 1972-73 yielded a central Ministry of Administration,

Country Planning, and Environmental Protection, and an Institute of Meteorology and Water Management.

Throughout this postwar period, water management in the Warta basin and Poland generally focused on technical planning and the construction of physical facilities (for drainage, retention, flood protection, and navigation) to support industrial and agricultural development. Water resource expenditures were almost exclusively for water works and relied heavily on central government plans and funding. Centrally-appointed District Directorates of Water Management (DDWMs) were established beginning in 1964 to construct and operate water works—first five, then seven, located on the principal rivers in Poland, with two DDWMs on portions of the Warta River.

On the other hand, domestic water supply, sanitation, and wastewater disposal were decentralized, local functions with no meaningful planning and management at a regional or river basin scale. The extent and quality of these services was especially problematic in rural regions. By the late 1980s, as the entire governmental system faced a period of crisis and transformation, Polish water resource professionals understood the need to switch to river basin management, and to broaden the focus of water policy toward IWRM—taking into consideration natural and ecological requirements, as well as public health and safety and economic development.

Until 1991, the main governmental entities responsible for water management at the sub-national level were not fitted to river basin boundaries. The DDWMs worked along the main stems of some rivers, but not on river basins as a whole. The other regional body was the voivodeship—at that time there were 49 voivodeships in Poland. The voivodes governing these provinces were responsible for rivers and streams that were not being managed by the DDWMs, for irrigation and drainage, and issuing water permits.

The 1989-91 period of the democratic transformation in Poland was an "open policy window" (Kingdon 1995). Rethinking of governmental structures and procedures throughout the country provided the opportunity for an organizational reform such as the creation of river basin management authorities. In February 1991, the Polish government announced the creation of a system of Regional Boards of Water Management (RBWMs), conforming essentially to river basin boundaries. Their principal purposes were to arrest the further pollution of water supplies, protect drinking water sources, and aid water users and water user organizations in developing and implementing rational water management. Their responsibilities concerned the balance of water supplies and demands, determining the conditions and terms for the use of basin waters, and developing and maintaining a new water information system.

The RBWMs were related directly to the national government's Ministry of Environment. Each RBWM director was an individual[8] charged by the ministry with management of the basin. There was little provision for public participation or water user involvement in RBWM decision making. Also, the DDWMs were kept in place, maintaining their responsibilities for the operation and maintenance of water works on their designated river reaches, so in the Warta basin the RBWM covered the entire basin while two DDWMs still operated along portions of the river's main stem.

[8] Despite the name Regional Board of Water Management, there really was not a "board."

This structure resulted partly from the fact that the RBWMs' creation was supposed to be accompanied by a thorough revision of Polish water law and policy. A new national water policy was expected to provide a basis for different systems of decision making about water resource conditions and efforts to improve them—essentially, IWRM with a more participatory structure for decision making. The reforms in water law and policy took much longer than expected, however.

In late 1999, the Minister of Environment decreed a merger of the DDWMs and RBWMs and their separate operations into seven Regional Water Management Authorities (RWMAs) covering the entire country and corresponding primarily though not precisely with Poland's principal river basins (Figure 1):

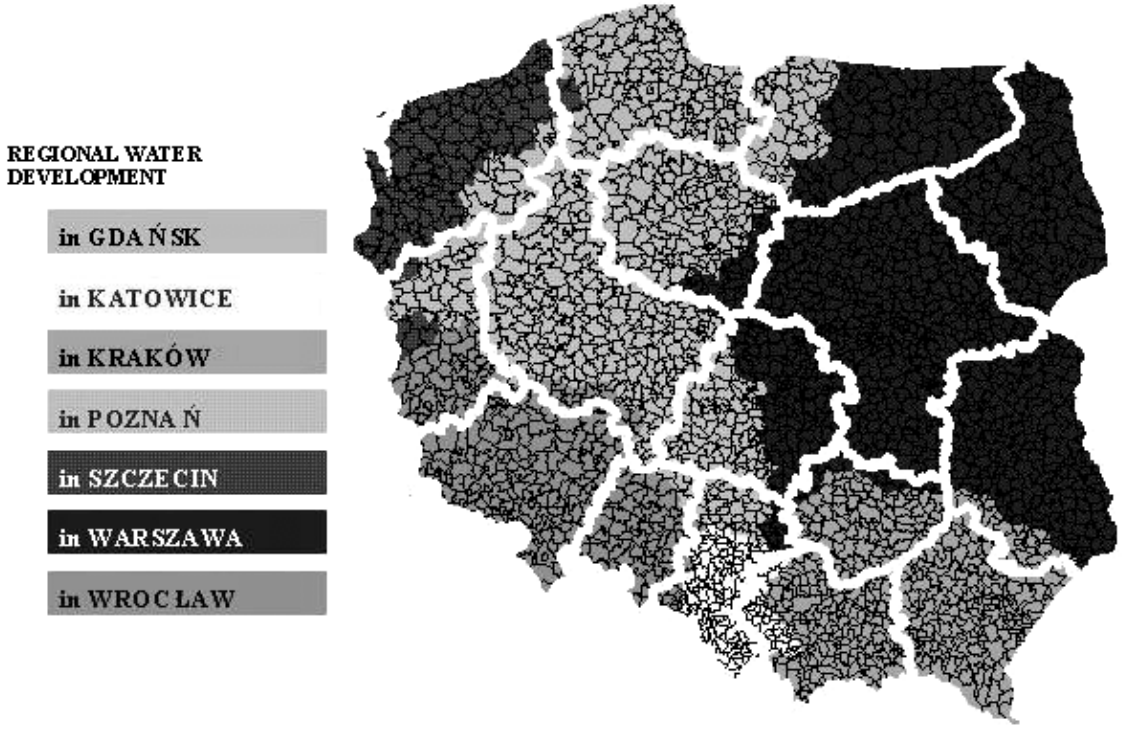

Figure 1. RWMA Territories, with Voivodeship Boundaries Shown

1. The RWMA in Katowice covers the Vistula River basin from the Vistula's source to the mouth of the Przemsza River, and the Oder River basin from the Polish border to Kędzierzyn-Koźle.
2. The RWMA in Krakow covers the Vistula River basin from the mouth of the Przemsza River to the mouth of the Sanna River.
3. The RWMA in Warsaw covers the Vistula River basin from the mouth of the Sanna River to Korabniki.
4. The RWMA in Gdansk covers the Vistula River basin from Korabniki to the sea and the basins of the east littoral rivers.
5. The RWMA in Wroclaw covers the Oder River basin from Kędzierzyn-Koźle to the mouth of the Nysa Luzycka River.

6. The RWMA in Poznań covers the Warta River basin from its source to its mouth at the Oder River.
7. The RWMA in Szczecin covers the Oder River basin from the mouth of the Nysa Łużycka River to the mouth at the sea, excluding the Warta. It also includes the basin of the west littoral rivers.

On behalf of the central government, RWMAs perform IWRM planning and coordinating functions within river basins, overseeing the actions of voivodeship and local governments and private users for compatibility with basin water management plans, and maintaining specified water works and state-owned reservoirs and other facilities. Tasks related to these functions include:

- monitoring and forecasting surface water and groundwater demand conditions,
- determining the conditions of use of integrated water resources in the basin,
- acting as a party in legal proceedings in cases regarding the specific use of inland waters and in other administrative proceedings pertinent to water management and protection,
- formation of, and communication with, Regional Councils of Water Management (RCWMs) composed of representatives of water users and other organizations, to have opportunities to comment on water management plans and environmental impact assessments,
- collecting charges and fees for navigation and sluice operation, for materials extracted from surface waters, and for leasing of the shore or river bank areas and use of facilities,
- providing opinions on designs and siting of developments that may appreciably affect water conditions and facilities located along river banks,
- cooperating on water management with, among others, the Inspectorates of Environmental Protection, the Institute of Meteorology and Water Management, maritime offices and regional forestry boards,
- cooperating on transboundary waters in compliance with the effective legal provisions and international agreements,
- keeping water resource databases (cadasters) and GIS,
- initiating studies and research on the development and protection of surface and underground waters,
- developing plans and programs for water resources management, water protection, and flood and drought prevention, and
- participating in flood emergency operations.

RWMAs have a legally recognized role in the water use and discharge permitting procedures that are carried out by voivodeship or local (poviat or starost) offices. This allows RWMA staff to be aware of activities and investments in environmental protection and improvement in the basin, and to object to permit applications that the staff concludes will harm basin conditions. RWMA staff also can identify and try to discourage developments that may threaten surface or groundwater quantity or quality. The RWMA can also request modification of permits.

RWMA Poznań also provides opinions and recommendations to provincial and local governments about financing water quality improvement projects, in particular the construction of wastewater treatment facilities. RWMA Poznań has been deeply involved in the process of construction of new wastewater treatment plants for the cities of Łódź and Poznań, which contribute much of the point-source pollution in the basin.

The RWMA maintains and operates facilities that regulate river flows for water supply and environmental protection, and for the facilitation of navigation. RWMA Poznań owns and operates the regulatory reservoirs in the basin that maintain river flows. Reservoir releases are also a means of addressing water shortages. Voivodeships in the basin have the formal authority to declare drought emergencies. Once an emergency has been declared, the RWMA can alter reservoir operations and conditions of water use permits in those portions of the basin. This procedure has not been used yet, and there is a reluctance to do so because of its likely impacts on water users.

With respect to flood control and protection, the RWMA's function is mainly to serve as a coordination and information center, providing decision support for flood prevention, flood control, and flood response. RWMA staff have prepared flood hazard maps, planned the construction of additional flood control infrastructure and maintenance of existing infrastructure, and supported public information and education. RWMAs make recommendations about emptying reservoirs for flood protection, although those recommendations must be approved by the voivodeship director of emergency management services. If the voivodeship director refuses the RWMA's recommendation, the director assumes liability for any flooding that occurs.

RWMA Poznań receives an annual budget allocation from the central government, distributed through the Ministry of Environment. Some of the RWMA's functions in managing state-owned facilities generate fee revenues, but most of that revenue goes directly to the Ministry of Finance. Overall, 99.5% of the RWMA's budget comes from the central government.

In addition to its main office (in Poznań), the RWMA has three local offices serving basin subareas:

- One in Poznań, addressing the middle and lower Warta River and the Prosna River.
- One in Bydgoszcz, addressing the Notec River.
- One in Sieradz, addressing the upper Warta River.

All together, RWMA Poznań has 322 employees. About half (150) are highly educated and professional staff (e.g., engineers, attorneys), and the others are technical and operations staff.

5.2 Integrated Water Resource Management (IWRM) and Polish Water Policy

Revisions to Polish water law, anticipated when the RBWMs were created in 1991, were long delayed. It was not until 1995 that the draft of a new water law was introduced in

parliament. During 1996, it became apparent that objections within parliament were too strong to get the proposed new law passed, and in February 1997 it was rejected.[9]

The decade-long delay in revising the national water law, from 1991 through 2001, created some significant problems for the basin management agencies in carrying out the range of functions for which they were created. One was financial: throughout the delay, the basin agencies lacked authority to generate their own revenue from fees for specific water uses. Also, the basin agencies were expected to coordinate flood protection activities among the municipal (gmina), county (poviat or starost), and voivodeship levels. This was especially difficult while there were so many voivodeships—49 nationwide, with 19 in the Warta River basin alone (Kundzewicz and Chalupka 1994). Also, until 1997 the flood protection activities of those other levels of government consisted of flood response, not planning and prevention.

Toward the end of the 1990s, efforts to rationalize management functions and shift policy toward IWRM resumed in earnest. Broader reorganizations of Polish government in the late 1990s—including the consolidation of 49 voivodeships into 16—provided an occasion for reconsidering the distribution of responsibilities for water and wastewater, as well as a host of other governmental functions at the subnational level. Desires to achieve some economies and end the separate structures of the DDWMs and the RBWMs contributed as well. Poland's movement toward EU accession (which occurred May 1, 2004) also made it necessary to focus on IWRM in order to begin aligning Polish policy and practice with EU standards and expectations. The combined result of these forces was a flurry of changes in Polish water policy and institutions during 1999-2002.

After the proposed water law failed to pass in 1997, the Ministry of Environment, representatives from the RBWMs, and other interested agencies and groups began working on a new proposal. It was introduced in parliament in 1999, and worked its way through parliament's multi-step approval process during 2000 and early 2001. Also enacted during 2001 were two other laws relating to water resources: the Act on Collective Water Supply and Wastewater Discharge Systems, and the Act on Environmental Law. These fit into the most important legal elements of Polish water policy, which are:

- the 2001 water law;
- the 1991 Environmental Inspection Act and the 2001 Environmental Law;
- the 2001 Act on Collective Water Supply and Wastewater Discharge Systems, establishing responsibilities of public water suppliers and wastewater dischargers;
- the 1994 Land Development Act, relating to urban and rural land use planning; and
- the 1990 and 1998 laws establishing the structures and powers of regional and local government units (voivodeships, powiats, and gminas).

[9] While the new law was failing in parliament, the Minister of Environment still wanted to get some changes made, and in April 1997 succeeded in getting an amendment (essentially a new chapter) added to the old law. It contained some important provisions, including the requirement that RWMAs be consulted by provincial and county governments about the issuance of water use or discharge permits.

The 2001 water law, with 220 articles, is quite detailed and specific concerning water management generally, and river basin management in particular. It reformed the RWMAs, dissolved the DDWMs, and added a consultative structure for basin stakeholders. Each RWMA must establish a Regional Council of Water Management (RCWM), composed of water users and representatives of the other governmental units in the river basin.[10]

The new water law contains a statement of priorities for the nation as a whole, and of priorities among water uses. Public drinking water is the highest priority use. The law further specifies that groundwater resources should be protected and preserved for public drinking water supplies and other uses that require clean water (e.g., certain industries). All other consumptive uses (i.e., industrial, urban non-potable, and irrigation) are secondary, and their relative priorities depend on basin circumstances. Water use conditions and priorities at the basin scale are to be determined by RWMA directors in basin plans that must meet with the RCWM's approval after wide public consultation.

The new water law also required the establishment of a National Board of Water Management (NBWM), which will be the principal water management entity at the national level, displacing that responsibility to some degree from the Minister of Environment and the Department of Water Resources within that ministry. Board members will include the RWMA directors, who will no longer relate directly to the Ministry of Environment but to the NBWM. The NBWM, headed by a president, will also assume responsibilities such as:

- supervising the activities of the RWMA directors, harmonizing their activities, approving their basin plans and progress reports, and recommending occasional inspections concerning water management in a region;
- elaborating plans of water management for the territory of the state (i.e., lands beyond the jurisdictional reach of the RWMAs), taking into consideration the river basin divisions;
- drafting flood protection and drought mitigation plans on the territory of the state;
- keeping a water cadastre for the nation, taking into consideration the division into the river basin districts;
- approving projects concerning water use in the river basins;
- supervising the operation of hydro-meteorological and hydrogeological surveys;
- representing the State Treasury with respect to property related to water management and in particular, overseeing the performance of tasks related to maintenance of waters or water works; and
- adjusting, with respect to matters related to water management, draft lists of priority projects of the National Fund for Environmental Protection and Water Management.

[10] These councils are to consist of about 30 persons, with half of them being water users. The others would be representatives of various self-governmental/administrative bodies (e.g., provincial and/or local offices) and of other organizations. The regulations for the establishment of these regional advisory councils were finalized in December 2002, so they have just been created recently.

The president of the NBWM is to be advised by a 30-person National Council of Water Management (NCWM), first appointed in June 2002, which represents diverse disciplines and constituencies related to water resource management.[11] Pursuant to the new water law, the NCWM's activities are to provide advice on the matters of water management, flood control and drought control, and in particular to:

- present proposals on improving water resource and flood control conditions throughout the country,
- offer opinions on proposed investment plans and programs for water management, and
- offer recommendations for further legal reforms in relation to water management.

The new water law contains a framework for the division of jurisdiction among a number of bodies:

- the minister competent for maritime management will have jurisdiction with respect to territorial and internal sea waters, including the waters of Gdańsk Bay;
- the NBWM President (with cooperation of the RWMAs) will have jurisdiction with respect to particular surface and underground waters relevant to flood protection and other broad national concerns;
- the director of a national park will have jurisdiction with respect to waters within the borders of the park;
- the Marshal of a voivodeship acting for the voivodeship authorities will have jurisdiction with respect to irrigation and drainage waters for the purpose of enhancing productivity, and with respect to other waters as specified.

Water policy in Poland also uses financial instruments to provide incentives for water conservation and for water quality protection. The principal financial instruments used currently include:

- fees for the "use of the environment" (i.e., discharges of wastewater and other wastes to receiving waters) by businesses;[12]
- fees for withdrawals of surface and underground waters;[13]

[11] The NCWM members are nominated by the national organizations of various self-government entities, by academic and other scientific and research entities, and by social, economic, and ecological organizations that relate to water management. Twenty of the 30 persons first appointed to the NCWM held the title of Professor or Assistant Professor; 23 were listed as holding doctoral degrees and the other 7 as holding master's degrees.

[12] The revenues generated by fees for use of the environment are distributed among the national, 16 voivode, 373 poviat, and 2,489 municipal funds for environmental protection and water management are distributed among the national, 16 voivode, 373 poviat, and 2,489 municipal funds for environmental protection and water management and are transferred, respectively, in the proportion of 19.6%, 50.4%, 10% and 20%.

[13] In Poznań city, the fees as of January 2003 were as follows: 0.1242 zl/m^3 (~US$ 0.031/m^3) for raw surface water intake for production (industrial) purposes; 0.392 zl/m^3 (~US$ 0.098/m^3) for groundwater intake for production purposes; surface or groundwater intake for nonproduction purposes, 0.0208 zl/m^3 (~US$ 0.0052/m^3). With the additional costs of treatment and distribution, the water supply charges paid

- a "retention fee" related to the reduction of natural water retention caused by interfering with natural flows (e.g., as a result of land development, changes in land use, etc.);
- fines for illegal or excessive water withdrawals;
- fines as for exceeding the limit values specified for waste discharges;[14]
- financial assistance in the form of grants and preferential credits from the national, provincial, county, and municipal funds for environmental protection and water management;
- financial assistance in the form of grants and preferential credit from the Bank for Environmental Protection (*Bank Ochrony Srodowiska S.A.*, or BOŚ) and from foundations supporting environmental investments;
- tax preferences such as opportunities to deduct expenses and donations for environmental protection, reduced VAT rates for manufacturers of certain goods and those who render ecological protection services, etc.

Although this period of water law and organization reform is only now drawing to a close, it is possible to provide a description of the current state of affairs. As part of natural resource and environmental policy generally, water policy is supposed to be based on principles of sustainable and rational resource use, with particular reference to:

- the basin principle - water management should be principally organized and take place within the designated basin areas;
- the democratization principle – public involvement and participation in decisions regarding the development and use of water resources;
- the administrative principle - control and supervision of the overall water resources;
- the centralist principle - leaving strategic and fundamental financial means in the hands of the central authorities;
- the market principle - aimed at making water use more economical and efficient.

Applying these principles, the main targets of IWRM in Poland are:

- improving the quality of surface and underground waters;
- assuring water availability for the population and the economy;
- reducing flood destruction and damage;
- limiting erosion of river banks and bottoms;
- safe operation of hydraulic facilities; and

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by an average end-user household were 1.9 zl/m^3 (US$ 0.475/m^3). The fee paid by end-user households for sewage disposal service was 2.42 zl/m^3 (US $0.605/$m^3$).

[14] Fines e.g. for violating withdrawal or discharge limits or using of the environment (water resources) without permit are in spite of funds additionally distributed among Chief Inspectorate of Environmental Protection, respectively in the proportion of 19.6%, 36.4%, 10%, 20% and 14% for CIEP. Revenues collected by funds are devoted to assisting financially with investments that serve environmental protection and water management purposes, e,g, water treatment facilities.

- setting conditions for water use for the power industry, navigation, and recreation.

National policy also requires that these targets be pursued in harmony with social and economic needs as well as with the needs of environmental protection.

5.3 Other Organizations and Management Responsibilities in the Warta Basin

Despite the nationwide system of RWMAs, water management authority and responsibility is far from being integrated at the basin scale. The RWMAs have numerous tasks and responsibilities with respect to water planning and management, facilities operation and maintenance, and coordination and consultation with respect to water use, water quality, and flood control, but decision making authority and funding for several of those tasks have been assigned elsewhere in the Polish governmental system. By no means should IWRM in Poland be viewed as centered in the RWMAs.

An emerging federal system in Poland distributes authority to a number of governmental levels and types (Tonderski and Blomquist 2003). Democratic Poland in the 1990s reorganized and strengthened its provincial and local governments, decentralizing a number of governmental services and functions, establishing fewer but more powerful provincial governments, and resurrecting municipal governments that had been all but destroyed during the Soviet era. That process, which occurred over the same period as the establishment of river basin authorities and the reform of Polish water law and policy, resulted in the spreading of authority for several aspects of IWRM across a number of governments. National bodies such as the new NBWM influence water policy and management as well, and national policy assigns special responsibilities for certain water resources to other entities altogether (e.g., in national parks, coastal zones).

The use of economic instruments for water management was mentioned in the previous section. Fees and penalties are collected from water users and wastewater dischargers. Those revenues are not distributed to or retained by the RWMAs, but are apportioned among the national, provincial (voivodeship), county (poviat or starost), and municipal levels of government as presented in footnotes 6 and 8 above. The revenues are available for projects to improve environmental conditions, including water resource conditions.

Beginning in 1989, the Polish government established a system of Funds for Environmental Protection and Water Management to which the fee and penalty revenue is distributed. The Funds are organized at the national, voivodeship, county (*poviat* or *starost*), and municipal (*gmina*) levels. The Funds have their own governance and administration structure and personnel, which do not correspond with or depend on the RWMAs. RWMAs can provide advice about water improvement priorities within their respective basins, but the choice of projects to assist is up to the Funds rather than to the RWMAs. A substantial portion of the revenues received by the Funds has been devoted to water quality improvement projects, especially treatment plants, but there is no institutional arrangement for prioritizing and funding projects at the river basin scale.[15]

[15] Additional sources of funding for environmental improvement projects include: 1) the Bank for Environmental Protection (BOŚ), established in 1991, which offers preferential credits for environmental protection and water management projects, in cooperation with the National and Provincial Funds for

The other primary element of improving water quality is through the issuance of wastewater discharge permits, the placement of conditions on those permits, and penalties imposed for unauthorized discharges. In the Polish system, permits are issued by county (poviat or starost) or voivodeship bodies, depending on the size (volume) of the permit request and the scope of its potential impacts. The permit issuing body must follow guidelines provided by national law, and are required to consult with the relevant RWMA before deciding to grant, conditionally grant, or deny the permit. Monitoring and enforcement of discharge permits and of unauthorized discharges is a responsibility of municipal (gmina) or voivodeship officials, not the RWMA. Water quality at municipal water supply intakes is checked by voivodeship Sanitary and Epidemiological Stations.

Water quality standards (which, as mentioned, are being revised in conjunction with EU accession) have been established by the Ministry of Environment, and under the new law will be shifted to the National Board of Water Management and to the RWMA directors. Thus the NBWM and RWMAs will have to establish and revised water quality standards, and determine strategies and priorities for improving compliance with them.

The primary means of controlling water demand is through the issuance of water use permits.[16] These permits are issued by county (poviat or starost) or voivodeship officials, depending on the size (volume) of the request and the scope of its potential impacts. Under the new water law, RWMAs are required to establish basin plans that include water use priorities and conditions in the basin. The law obliges the counties and voivodeships to follow those priorities and conditions when deciding whether to grant, conditionally grant, or deny permit applications, and to consult with the RWMA. In the case of applications to withdraw groundwater, the new water law adds a requirement that counties and voivodeships establish and apply depth limitations for the approval of permits. Monitoring and enforcement of water use permits or unauthorized water uses are the responsibility of municipal (gmina) and voivodeship officials, not the RWMAs.

Water tariffs are demand management tools that affect water supply availability and reliability. Tariffs are not set by RWMAs but by municipal (gmina) officials—the mayor and city council, typically—whether water supply is provided directly by municipal government or by a utility or private company under municipal regulation. In rural areas, irrigation systems and drainage systems are regulated by the voivodeship administration, with funding support from the central government.

Flood control and flood response are municipal and county responsibilities, under the supervision of a voivodeship department of emergency management. The voivodeship office may take over flood response if an incident surpasses municipal and

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Environmental Protection and Water Management; 2) the Rural Areas Aid Foundation (*Fundacja Wspomagania Wsi*), 3) Polish Agency for Regional Development (*Polska Agencja Rozwoju Regionalnego*), 4) European Fund for the Development of Polish Rural Areas (*Europejski Fundusz Rozwoju Wsi Polskiej*), and 5) the Foundation of Aid Programmes for Agriculture (*Fundacja Programów Pomocy dla Rolnictwa*, also known as the Counterpart Fund). Poland also receives financial aid for water projects under bilateral agreements and through international organizations (e.g., International Monetary Fund, the World Bank Group, and the EU).

[16] As under the 1974 water law that established the first permit requirement, individual households and small farms using 5 m^3 or less per day are exempt from needing a water use permit. The 2001 law continues those exemptions but restricts them to water withdrawals for normal domestic and farming uses on the property. The exemption avoids the administrative difficulty and cost of bringing so many small users into the permit system.

county boundaries. RWMAs provide information on flood hazards and forecasts, maintain and operate reservoir facilities on the rivers, and plan for the construction of additional facilities if needed.

To summarize, national laws and regulations constitute a framework within which basin and sub-basin actors perform their functions, which include:

- RWMA functions, focused mainly on:
  - IWRM planning;
  - Promoting compatibility of other governments' water management actions with basin and national plans and policies through monitoring, or through review and comment; and
  - Operational functions concerning reservoirs and other facilities.
- Voivodeship level functions, particularly
  - Permitting (done by the Environmental Protection and Agriculture Departments in 8 voivodeships in the Warta basin);
  - Funding environmental improvement projects (done by the Funds for Environmental Protection and Water Management in the 8 voivodeships);
  - Monitoring and enforcement (done by Inspectorates of Environmental Protection in the 8 voivodeships); and
  - Management of irrigation facilities and primary drainage systems (done by voivodeship Boards of Land Improvement and Water Devices in the 8 voivodeships).
- Poviat level functions, particularly
  - Issuing water use and water discharge permits;
  - Monitoring and enforcement (done by environmental protection departments of poviat's offices);
  - Flood protection activities;
  - Fisheries protection; and
  - Funding environmental improvement projects (done by the poviat Funds for Environmental Protection and Water Management).
- Gmina level functions, particularly
  - Water quality enforcement for providers of public water supplies and wastewater service;
  - Funding environmental improvement projects (done by gmina Funds for Environmental Protection and Water Management);and
  - Monitoring and enforcement (done by gmina environmental protection departments).

6. Participants' Motivations, Incentives, and Actions

RWMA Poznań would prefer to have both increased funding and increased autonomy, but the director is aware that the central government is reluctant to provide both. Now that RWMAs cover the entire country and the old division between the RBWMs and the DDWMs has been eliminated, RWMA staff see the RWMA as the logical choice to be the principal IWRM entities in Poland, but would be reluctant to accept that greater responsibility without additional finances. Particular frustration accompanies the exclusion of the RWMA from a share of the revenues that flow to the Funds for

Environmental Protection and Water Management at the national, voivodeship, and local levels. Unless some improved funding base is provided for the RWMAs, the staff will continue to have mixed motivations about how vigorously to perform the leadership roles that the new water law opens up to them.

Central government officials have been trying simultaneously to construct a federal democratic republic and implement IWRM at the river basin level, in response to signals from supra-national actors. The effort to pursue both goals simultaneously has contributed to geographical and jurisdictional mismatches between the RWMAs and the voivodeship and local governments. Central government officials are concerned with achieving and maintaining compliance with EU regulations at levels adequate to secure continued EU support. This is one reason for not granting more autonomy to the RWMAs and trying instead to make them as nearly identical to one another and as closely tied to national policy as possible. National officials are interested in "harmonizing" the RWMAs for the sake of policy consistency but also for the sake of administrative convenience. On another topic, national officials can also be presumed to want to avoid the economic losses and the political blame that would results from another major flood incident such as 1997.

The government's determination to enter the EU as soon as possible affects most aspects of its economic and environmental policies. The water sector has been no exception in this regard. National water law and policy has largely been reconciled with the EU Directive as a result of the 2001 legislation (Blaszczyk 2002). What remains to be done over the next few years is to conform the details of regulations, and the actual practices of water suppliers, wastewater dischargers, and public agencies involved with management of water resources, to the Directive's requirements. "Special plans for the implementation of the directives concerning urban wastewater treatment and hazardous substances have been prepared. Legal acts impose certain obligations onto the 'dischargers' of wastewater regarding modernisation, modification, construction or reconstruction of treatment facilities, and in the case if industry—compliance of technology with present requirements (BAT)." (Blaszczyk 2002)

Because EU accession is a national government responsibility, government offices at the subnational level will also have a role in that process. For example, the Department of Environmental Protection and Agriculture of Wielkopolskie Voivodeship is developing a program for sewage treatment facilities—which is in large measure a compilation of local government plans for treatment facilities—and this program along with the programs of the other 15 voivodeships will comprise much of the Polish national response to EU rules concerning wastewater treatment.

Voivodeship regulators are concerned with maintaining compliance with national regulations at levels adequate to secure continued funding. Keeping authority over permit issuance, environmental enforcement, and the financing of environmental improvement projects are all means to that end. Ceding or sharing control of these functions with RWMAs is not a desirable alternative from the perspective of voivodeship officials. It must also be remembered that the issue of jurisdictional and geographical mismatches cuts both directions: just as it may be frustrating to an RWMA to deal with multiple voivodeships, there are voivodeships in Poland (such as Lodz) which must deal with more than one RWMA. Voivodeship officials can also be presumed to want to avoid the economic losses and the political blame that would accompany a reoccurrence

of a major flood event such as 1997, and thus to support investments in flood control projects.

Provincial and local officials face incentives to grant water use permit applications that will facilitate economic growth, as Poland continues to recover from decades of relative economic stagnation and tries in the future to catch up to its EU counterparts. This creates some difficulty in arresting the growth of groundwater use in urban and industrial areas already experiencing declining groundwater levels. On the other hand, the fee structure (which directs a portion of environmental penalty collections back to the local governments) provides a mild incentive to monitor and enforce environmental compliance.

Agricultural water users want to maintain access to cheap, plentiful water with minimal regulation of use. Keeping the exemption for on-farm water use and water discharge is a logical course of action consistent with that motivation. Industrial water users also can be presumed to want cheap, plentiful water, with minimal regulation and maximum subsidization of waste disposal. Discharge fees are more acceptable to this sector if the revenue supports projects such as treatment plants that help maintain surface water quality and avoid further restrictions on industrial discharges.

Municipal water suppliers have focused on source water quality protection and improvement, which help minimize treatment costs and rate pressures. Of course, rate pressures can also be lessened by subsidization of treatment plants. The latter can be obtained from the Funds for Environmental Protection and Water Management, primarily at the voivodeship level. Water suppliers operating as enterprise utilities (e.g., Poznań) also have an interest in seeing tougher regulations on rural and other suppliers, so the full-cost recovery rates of urban utilities do not diverge too radically from the costs of water provided by other nearby suppliers.

Environmental interests have seized the democratization process in Poland since 1990s to pursue opportunities for representation in a water policy sector that was largely closed to them before. The creation of an NCWM and the RCWMs with a prescribed distribution of seats provides such opportunities. EU accession, which brings a layer of supranational environmental regulation to bear upon Polish governments, also serves the interests of environmental organizations in Poland.

7. Performance Assessment

7.1 Water Quality

Water quality remains a great challenge in the Warta basin, and the results of efforts to improve it are mixed. Rivers remain polluted with bacteriological and chemical contaminants. Direct water quality measures include concentrations of contaminants. Indirect water quality measures include indicators such as fish population, size, and species variety. By both kinds of measures, water quality in the Warta basin has improved with respect to some indicators, and worsened in other places or with respect to other indicators.

Waterborne diseases have not been considered a significant issue in Poland for decades. Generally, water supply facilities have provided waters of good hygienic quality. Much effort toward water quality improvement has focused instead on reducing untreated wastewater discharges from urban areas.

Water quality improvements are not lagging for lack of effort or expenditure.[17] Recent investments have stimulated the development of additional sewage treatment plant capacity. The wastewater treatment plant for the Łódź metropolitan area, completed at the end of 2001, is the biggest treatment facility in Poland (average incoming inflow during dry weather 192,000 m^3/day and during rainy weather 644,000 m^3/day). This plant now serves 750,000 people, and its advanced technology meets Polish and European standards. The second large wastewater treatment plant, serving Poznań (150,000 m^3/day), has been equipped with the same advanced technology.

Most municipalities in Wielkepolskie voivodeship now have sewage collection systems. The countryside lags far behind, though. EU funds for rural development have been and will be helpful in improving the quality of water discharged in rural areas.

Industrial and other discharges continue to take their toll on water quality, however. The poorest water quality is generally found in the portion of the river from just above Jeziorsko reservoir downstream to the Prosna River. The stretch of the Warta between the Ner mouth and the Prosna mouth is among the river's most polluted portions. Inflow from the Prosna River, farther down the Warta stem, reduces the pollution concentrations in the Warta from that point to its junction with the Oder. Downstream of the Warta inflow, levels of cadmium and nutrients in the sediments of the Oder increase, reflecting agricultural and industrial (especially electronics manufacturing) activities upstream in the Warta. (Muller et al. 2002: 244) The cadmium increase is from 9 mg/kg upstream of the Warta mouth to 16 mg/kg downstream. (Muller et al. 2002: 249) On the other hand, the concentrations of arsenic, copper, and mercury in the Oder sediments decline below the mouth of the Oder, so "the Warta sediments are less contaminated with these metals than Odra sediments sampled upstream." (Muller et al. 2002: 249)

As for organic contaminants (e.g., DDT, PCB, PAHs) the Oder downstream of the Warta showed decreases, again indicating that concentrations of these contaminants were lower in the Warta than in the rest of the Oder river basin. (Muller et al. 2002: 250) Total organic carbon (TOC), composed of dissolved organic carbon (DOC) and particulate organic carbon (POC), in the Warta is slightly lower than in the Oder and Vistula, according to sampling performed in 1995. Organic contaminant concentrations peak in the Warta in August (toward the end of the dry season, when river flows are diminished) and trough in December, according to sampling performed in 1994 by the Institute of Meteorology and Water Management. (Siepak 1999: 284)

TOC concentrations in all three major Polish rivers were much higher than the Rhine or Rhone rivers elsewhere in Europe, or the Mississippi or Yukon rivers in North America (Siepak 1999: 284), and were higher in 1994 and 1995 than in 1991. Siepak (1999: 284) attributes the increased TOC to "the pollution by industrial and municipal wastes caused by a lack of biological purification plants for large cities on the rivers." The newly completed wastewater treatment plants for Łódź and Poznań should improve this situation.

[17] This is true of environmental protection generally, and on a nationwide scale. Investment outlays for environmental protection in Poland have increased almost fivefold since 1990, although Poland has reached only about half the level of West European countries. Appreciable progress is also observed in appropriations for environmental protection as a share of national economy investment outlays (from 3.6% in 1990 to 8.0% in 1999) or of the Gross Domestic Product (in 1998 it reached 1.6%).

Ten years of data on the presence of surfactants (compounds used in cleaning products such as laundry soap) in the Warta at Poznań found declines in anionic surfactants but a substantial (six-fold) increase in nonanionic surfactants during the 1990s. Some of this change reflected the changing ratio of these compounds in cleaning products themselves, but that alone would not account for the size of the increase in nonanionic surfactants. Data from measuring stations at other points along the river indicated that concentrations of nonanionic surfactants were highest downstream of the industrial cities of Czestochowa, Sieradz, and Gorzow. High concentrations were also found on the Ner river downstream of Łódź, where the anionic surfactant concentrations "were more similar to those of a raw sewage than surface water." (Szymanski et al. 2001: 375)

Fish populations, species diversity, and size and weight provide indirect indicators of water quality improvement or decline. For the most part, data on fish in the Warta River indicate that water quality still needs considerable improvement. In the farthest upper reaches of the Warta river, where water quality is significantly impaired by mining and other industrial discharges, no fish are found. (Przybylski 1996: 40) The next river portion—the stretch of the upper Warta between the Poraj and the Jeziorsko reservoirs, along which the riverbed and banks are natural—exhibits eutrophication problems but the highest fish population, growth rates, sizes, and species diversity. (Przybylski 1996; Penczak et al. 1998)

Both species richness and species diversity in the Warta drop dramatically along the stretch of the Warta from the Ner mouth to the Prosna mouth. (Przybylski 1993: 508) "Drastic changes in the fish fauna composition were noted in the polluted parts of the upper Warta, especially in the part above the inflow of the Ner River (pollution from the city of Łódź, via the Ner). In this part of the river, the species number is reduced to a minimum value of four." (Przybylski 1993: 506)

Along the middle of the Warta's course, a large and statistically significant drop in species richness and diversity occurs between the river stretches above and below the Jeziorsko reservoir. The number of species and their population and size were recorded at selected sites above and below the dam over an 11-year study period, 1985 (the year before the dam was built) through 1995 (Penczak et al. 1998; Penczak 1999; Glowacki and Penczak 2000). In the 10 years after the river was impounded, the number of fish species found below the dam decreased two- to three-fold while the number in the natural river course above the dam remained relatively constant.[18] Even after 10 years, the size and weight of fish did not recover to pre-impoundment levels upstream or downstream of the dam (Penczak 1999).

The Jeziorsko dam has no fish ladder, which obviously accounts for some of the negative impact on fish population. Two migratory species found in the river before the dam's construction became extinct thereafter (Penczak et al. 1998: 168). Even non-migratory fish below the dam are fewer in number and species diversity, and smaller in size. Some effects on non-migratory fish may be due to impacts on water temperature from the hydroelectric power plant at the dam—since the dam was completed, there has

[18] There was a sharp but temporary drop in fish population and species diversity above the dam in March 1989, when the trees and other vegetation along the riverbank were cleared. The population rebounded over the next three years as the vegetation grew back. (Penczak 1995a)

been no ice cover on the river for five kilometers downstream. The water released below the dam has also exhibited greater and rising alkalinity, and lower oxygen levels, compared with the water upstream. (Penczak et al. 1998: 162) In addition to stressing the fish population directly, these changes also affect their food supply. (Penczak 1995a: 57)

The opening and closing of the dam sluices appears to have the greatest effect on fish population, size, and species diversity, because of their effects on downstream aquatic and riparian habitat. Closing the sluices causes portions of the riverbed to be exposed for long periods, and when the sluices are reopened large pulses of water surge down the river course. Other pulses occur as a result of operation of the hydroelectric plant at the dam. (Penczak et al. 1998: 169) If the trend in fish species below the dam continues, soon "there will be no fish in the tailwater at all,' and this phenomenon may continue for many kilometers downstream. (Glowacki and Penczak 2000: 106) Barbel and nase are already extinct below the dam, and chub, dace, and gudgeon are in danger of extinction. (Penczak and Kruk 2000)

7.2 Water Supply Availability and Reliability

A top priority in the Warta basin is the development of additional small retention facilities (small and medium-sized reservoirs) for irrigation supplies, flood protection, and electricity. At the request of RWMA Poznań, the Institute for Meteorology and Water Management completed a study titled, *The Hierarchy of Needs in the Small Retention Areas*. According to this study, Wielkopolskie province in the center of the Warta River basin falls into the category of extreme needs. There are areas within the basin that have been in drought conditions up to 10 times over the past 30 years, and RWMA Poznań has also been targeting those areas for small reservoir improvements. The principal barrier to construction of needed facilities has been lack of funding. There was a national policy to promote water storage facilities such as small reservoirs, but funding has not been adequate to carry it out and the RWMA does not have funds of its own to devote to this purpose.

Installation of water meters, imposition of water tariffs, and updating the water use permit system hold the greatest promise for improving water supply reliability by managing the growth of water demands. RWMA Poznań started promoting water meters in the early 1990s. Meters had such a dramatic downward impact on water consumption that some urban water suppliers complained of the loss of sales. Compliance with the EU Water Framework Directive will require full-cost pricing, which may reduce consumption even further.

Although tariffs are a useful tool for restraining the growth of water demand, there is one difficulty with the current system of water use permits and water use tariffs in the Warta basin. Tariffs on permit holders are based on actual water use, not on the amount of the permit, so users tend to apply for larger permits than they will really need (since they will be charged only for what they actually use). Water resources in the basin therefore appear to be "over-appropriated" in places where they may not be. Water permits in the Prosna sub-basin, for example, already exceed available flow. The poviat decision makers have allowed additional permits in that sub-basin because they know that the permitted amounts do not reflect actual use. One suggestion to rationalize this system has been to base fees on permit amounts rather than actual use, but this would reduce the sensitivity of actual use to fee changes.

In urban and industrialized areas of the basin, economic growth has combined with greater reliance on groundwater to contribute to localized concerns about groundwater supplies. Declining groundwater levels are now evident in parts of the Warta basin near Poznań. It is not certain whether a sustained overdraft condition exists at present, but applications for new water uses in the Poznań poviat are being reviewed more carefully, and some have been denied.

In the rapidly growing municipality of Tarnowo Podgorne, just north of Poznań and near the middle reach of the Warta, groundwater levels have not shown a general areawide decline, but some individual wells have experienced diminished production. The municipal water system has recently connected with the Poznań water utility for backup supply, which is sometimes needed in the summer. Their contract with the Poznań utility sets a minimum amount that Tarnowo Podgorne will purchase whether they need it or not (a "take-or-pay" contract) and a maximum amount they can purchase. Tarnowo Podgorne has also reserved a new water intake in a neighboring community, which they can install and use if needed.

During drought conditions in the early 1990s, some permit holders in the Warta basin were unable to get their full entitlements. Some small restrictions were placed on water use then, with some irrigation and non-potable urban uses cut back in order to protect higher-priority potable and industrial water uses. At that time, voivideship officials decided on water restrictions. Under the new law, the RWMA director would make those decisions, and RWMA Poznań must develop plans for water restrictions during drought. A step in this direction is the development of a dynamic modeling process for assigning priorities among classes of water, tied to their respective vulnerabilities during a drought or other emergencies. This has been developed initially in the Prosna River sub-basin because data are available to support this kind of modeling.

7.3 Flood Control

Severe flooding occurred in the Warta basin as throughout Poland in 1997, and the risk of flooding has certainly not been eliminated. The central role in the basin's flood protection system is played by Jeziorsko reservoir, on the border between Lódz and Wielkopolskie voivodeships and completed in 1986. From November until March the reservoir is normally prepared to receive a flood wave of 203 Mm^3. The Jeziorsko reservoir, in connection with natural flooding capacity of the Koninsko-Pyzderskiej valley and the valley upstream of Poznań in the Rogalin area, provides good flood protection for Poznań, the basin's largest city.

Within its own catchment, the Noteć does not present significant flooding risks. This is mainly due to the area's land use, which is dominated by low-intensive pastures and meadows. However, below the Notec's confluence with the Warta, the city of Gorzów, about 200 km downstream of Poznań, is much more exposed to flood risks. This city is subject to water flow from the Noteć River as well as backwater from the Oder River. The city's only protection is provided by embankments that are in poor condition.

The Prosna River remains unpredictable, with a large flood potential that threatens another large city in the basin, Kalisz. Significant improvement of the situation will be achieved when a reservoir planned for Wielowieś Klasztorna, with about 50-70 Mm^3 capacity is built. RWMA Poznań advocates construction of this reservoir on the

Prosna River above Kalisz to provide control of a high water wave in order to avoid the superposition of waves from the Warta and the Prosna Rivers, thus reducing the flood hazard to Poznań as well as Kalisz.

8. Applying the Analytical Framework

8.1 Initial Conditions and Contextual Factors

The Warta basin does not feature significant cultural, religious, ethnic or other divisions within the population that hinder the prospects for successful river basin management. Similarly, asymmetries in the distribution of resources among basin stakeholders do not appear to have impeded the move toward the adoption of IWRM at the basin scale.

Economic development of the basin and the country have had effects, however. Poland's agricultural and industrial sectors emerged from the era of Soviet domination lagging behind the West. Support from international financial institutions and from the EU aided Poland's economic and political transition, and also provided incentives for reforms such as IWRM and the creation of river basin agencies. Still, Poland's economic conditions have led to financial constraints on the government sector, limiting its ability to provide either central funding or revenue autonomy adequate to the tasks of IWRM at the basin scale.

8.2 Characteristics of the Decentralization Process

The main point about the decentralization process has been made already in this paper: the decentralization of government in Poland, and the reform of water policy and water organizations, were attempted over the same (and relatively short) period of time, and the results of those simultaneous processes have not always been smooth. Significant responsibilities for water resource planning and management have been spread across basin and sub-basin agencies, and water law reform took several years longer than originally envisioned.

There appears to be no question, however, of the central government's commitment to decentralization and democratization reforms, or about its recognition of the local and basin-scale organizations that it created. Central government officials have maintained that commitment throughout the post-Soviet period. However, as noted above, they have held the pursue strings rather tightly in light of the limited financial resources available to the public sector in Poland.

8.3 Central-Local Relationships and Capacities

Overall, the water law changes in 1997 and 2001, and the merger with the DDWMs in 1999, have given the RWMAs more responsibilities but not additional sources of revenue. According to the RWMA director in Poznań and others, the RWMAs have not fared well in the national government's budgetary process. RWMA Poznań had a 2002 budget of $1.8 million, quite small for an organization covering such a large basin and employing so many individuals. Of this allocation, 73.8% is used for investments end planning in the basin, 5.9% for other development activities, 2.2% for water quality activities, 0.1% for operations and maintenance, and 18% for administration and other

categories. The small amount of financing has left the RWMAs unable to address the wide array of management concerns within the basin, or even to adequately fund maintenance of water works within the basin. The budgetary needs for maintenance and upgrading of facilities mount each year, and the backlog of needed (but unfunded) tasks accumulates. The RWMA Poznań estimates that fulfilling all of its responsibilities would cost about 100 million zlotys per year. It receives a budget of about 5 million zlotys per year. So the RWMA is unable to do everything it is supposed to do.

Still, it is important to reiterate here how quickly the institutional reforms have transpired. It can be argued strongly that with major reforms occurring in 1990, 1992, 1997, 1999, and 2002, there has not been enough time for the full implementation of basin management activities, or for a thorough assessment of their performance.

It should also be noted that the water rights system established in Poland (portions of which pre-date the democratic transformation) is in certain respects conducive to IWRM, and the reforms since 1990s have attempted to add a basin-wide perspective to that system. Permits for water use and water discharge are limited in time and quantity, and approved only after consultation about basin conditions. Fees associated with non-permitted actions or with permit violations provide incentives to users and also a revenue source for environmental improvement projects. Other reforms (such as transferability of permits) have yet to be undertaken, but most elements of the institutional infrastructure of a water rights system compatible with IWRM are in place.

8.4 Internal Basin-Level Institutional Arrangements

There are basin-level institutions in Poland, but as emphasized throughout this paper, those institutions are neither the beginning nor the end of the story. Management of the Warta River basin is substantially dispersed, polycentric, and federated. Its federated nature is seen by this comparison, provided by the RWMA Poznań director, of the distribution of water management responsibilities before and after the 1989-1991 period of initial decentralization reform that shifted Polish water management toward a river basin focus. Before creation of the RBWMs, water administration was 100% national, now is 65% municipal and county, 30% basin, 4% voivode, and 1% national. Before creation of the RBWMs, infrastructure financing was 100% national, now is 50% municipal and county, 30% voivodeship, and 20% national. Before creation of the RBWMs, water quality enforcement was 100% national, now is 60% municipal and county, 30% voivodeship, and 10% national. Before the reorganization, voivodes were 100% responsible for issuing water and wastewater permits; now this is done by poviat or voivodeship officials with the advice and consent of RWMAs.

This federal approach, with a sharing of responsibilities across levels and units of government, allows for the recognition of sub-basin communities of interest, and provides overlapping layers of monitoring and enforcement of water management regulations. It does not, however, lend itself to clarity of institutional boundaries or a close matching of jurisdictional boundaries to basin boundaries. The Warta case provides a clear reminder that jurisdictional boundary issues will arise within any river basin unless all water-related responsibilities are concentrated in the basin management agency, which is probably infeasible politically if not administratively. This is evident in the situation of Łódź voivodeship, which is intersected by and divided among two river basin authorities. It is also evident in the fact that the RWMA in Poznań has to interact with

several voivodeships that lie partly within and partly outside the Warta River basin. These interactions do not yet operate seamlessly, and require all of the actors to understand well their new roles.

Forums for information and communication sharing, and for conflict resolution, are essential in such a polycentric setting. The RCWMs and NCWM appear to be intended to aid in the information sharing and communication roles, but they are so new that there is no record from which to judge their operation at this time. Nor can the effectiveness of conflict resolution methods (which rely strongly on negotiations between governmental units) be assessed conclusively yet.

9. Conclusions

The Warta basin case illustrates how much institutional creation and policy reform can be accomplished in a relatively short period when a central government makes and sustains a commitment to decentralization and to IWRM. Fifteen years ago, Poland did not have a rational system of water tariffs, wastewater discharge controls, or water resource planning, let alone a set of river basin-scale organizations for water management. Now all of these are in place, albeit still quite new, along with bodies at the national, provincial and local levels for funding water quality improvements and other environmental protection projects.

The Warta basin case also illustrates, however, the gaps that can emerge between river basin management organizations on the one hand and a policy of IWRM on the other. In the period 1989-2001, the central government in Poland attempted to revise and reform the entire structure of general-purpose governments at the provincial and local levels, to decentralize several state functions to those levels, to create and then reorganize its system of river basin management agencies, and reform its policy approach to water resource management. While much has been accomplished, institutional boundaries have not always been clear, and some things have proceeded quite out of phase—principally, the establishment of the river basin agencies without a revenue source of their own, without a structure for basin stakeholder representation and participation, and a decade before the passage of the water law that largely defines and authorizes their activities.

Polish water policy has indeed embraced and moved toward IWRM, but the decentralization has spread water management responsibilities and authority across a large number of sub-basin entities. Organizational responsibilities and relationships appear to be substantially less integrated than policy. There are requirements for consultation of the RWMAs and conformity to basin plans, but until 2002 (with the creation of the RCWMs) there was no formal structure to integrate the general-purpose governments at the voivodeship and local levels into the RWMAs or vice versa. Currently there is a substantial gap between the basin-scale organizations that have been created in Poland and the activities that comprise IWRM, most of which have been assigned to sub-basin governments.[19]

[19] Consider, for example, the contrast between the river basin authorities in Poland and those in Spain, such as the one for the Guadalquivir river basin that is another case study in this research project. The Guadalquivir basin authority has substantially more management responsibility than RWMA Poznań, and is closer to an IWRM agency. It does permitting, monitoring of water use, monitoring of water quality—functions that in the Polish case continue to be spread among agencies and levels of government.

The Warta case serves as a reminder that IWRM (a policy approach) is one thing, and coordination at the river basin scale (an organizational approach) is another. One can be created and not the other, and it is possible for both to be attempted without being matched to one another. Harmonization of water resource management functions thus remains an unfinished agenda item for the Polish water sector as a whole and in the Warta basin in particular.

Abbreviations

Abbreviation in English	Explanation in English	Abbreviation in Polish	Explanation in Polish
BWM	Bureau of Water Management	BGW	Biuro Gospodarki Wodnej
CIEP	Chief Inspectorate of Environmental Protection	GIOŚ	Główny Inspektorat Ochrony Środowiska
DDWM	District Directorate of Water Management	ODGW	Okręgowa Dyrekcja Gospodarki Wodnej
IMWM	Institute of Meteorology and Water Management	IMGW	Instytut Meteorologii i Gospodarki Wodnej
Mm^3	Million cubic meters		
NBWM	National Board of Water Management	KZGW	Krajowy Zarząd Gospodarki Wodnej
NCWM	National Council of Water Management	KRGW	Krajowa Rada Gospodarki Wodnej
NFEPWM	National Fund for Environmental Protection & Water Management	NFOŚGW	Narodowy Fundusz Ochrony Środowiska i Gospodarki Wodnej
RBWM	Regional Board of Water Management	RZGW	Regionalny Zarzad Gospodarki Wodnej (stary)
RWMA	Regional Water Management Authority	RZGW	Regionalny Zarzad Gospodarki Wodnej (nowy)
RCWM	Regional Council of Water Management	RGWRW	Rada Gospodarki Wodnej Regionu Wodnego
VFEPWM	Voivodeship Fund for Environmental Protection & Water Management	WFOŚGW	Wojewódzki Fundusz Ochrony Środowiska i Gospodarki Wodnej
VIEP	Voivodeship Inspectorate of Environmental Protection	WIOŚ	Wojewódzki Inspektorat Ochrony Środowiska

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Appendix: Variables in the Analytical Framework

As noted in Section 2, the analytical framework used for this research project entails several variables hypothesized to be related to the success or failure of river basin management institutions, grouped into four categories.

Contextual factors and initial conditions

The literature on decentralized water resource management indicates that successful decentralization is at least partly a function of the initial conditions that prevail at the time a decentralization initiative is attempted. These initial conditions are elements of the social context of the decentralization effort. They include

- Economic development of the nation;
- Economic development of the basin area;
- Initial distribution of resources among basin stakeholders; and
- Class, religious, or other social/cultural distinctions among basin stakeholders.

Characteristics of the decentralization process

In countries that have attempted to decentralize water resource management to the basin level, characteristics of the decentralization process itself will affect the prospects for successful implementation. Two necessary conditions of a decentralization initiative are (a) devolution of authority and responsibility from the center, and (b) acceptance of that authority and responsibility by the local or regional units. Whether (a) and (b) occur will depend in part upon why and how the decentralization takes place. Important factors include

- Whether basin-level management was a local initiative to assume management responsibilities, a devolution that was mutually desired by local stakeholders and central government officials, or a decision by central government officials to shed water resource management responsibilities regardless of whether basin stakeholders wanted to assume them;
- The extent of central-government recognition of local-level basin governance; and,
- Whether central government officials maintained a policy commitment to decentralization and basin management through transitions in central government administration.\

Characteristics of central government/basin-level relationships and capacities

Because successful decentralization requires complementary actions at the central government and local levels, other aspects of the central-local relationship can be expected to condition that success. Political and institutional variables should be explored that relate to the respective capacities of the central government and the basin-level stakeholders, and the relationship between them. Key factors include

- The extent to which devolution of water management responsibilities from central government to basin institutions has been real or merely rhetorical, and whether devolution has been handled as a supportive transition to basin management or as an abrupt abandonment of central government authority;
- The financial resources available to basin-level institutions, and the extent of their financial autonomy;
- Basin management participants' ability to create and modify institutional arrangements that are tailored to their needs and circumstances;
- The extent of other experience at the local or regional level within the country with self-governance and service provision;
- The distribution (particularly asymmetries) of national-level political influence among basin stakeholders;
- Characteristics of the water rights system in the country which facilitate or hinder basin management efforts; and
- Whether basin-level institutions have had adequate time for implementation and adaptation of basin management activities.

The internal configuration of basin-level institutional arrangements

Successful implementation of decentralized water resource management will also depend on features of the basin-level arrangements created by stakeholders and/or central government officials. Important ones include

- The presence of basin-level governance institutions;
- The extent of clarity of institutional boundaries, and their match with basin boundaries;
- Whether and to what extent basin-level institutional arrangements recognize sub-watershed communities of interest;
- The availability of forums for information sharing and communication among basin stakeholders;
- The ability to make, monitor, and enforce contingent contracts whereby basin stakeholders can agree to contribute to improvements in basin conditions;
- The institutionalization of regular monitoring of basin conditions by means that are trusted by water users; and
- The availability of forums for conflict resolution.

Certainly, these factors will not all apply with equal significance in all cases. In each case, the emergence and path of river basin management will be affected profoundly by some of these variables, affected slightly by others, and not at all by some. Institutional analysis in a case-study setting consists largely in determining which institutional factors in what combination appear to have been linked to outcomes. Furthermore, many of the variables listed above have subjective components, and will be assessed differently by different participants and observers. It is therefore essential in these case studies that team members interview individuals with a variety of perspectives.